

Amendments to the Drawings

The attached proposed sheet of drawings includes changes to Fig. 1 and replaces the original drawing sheet of Figs. 1, 2, and 3. The reference sign '23' has been added to point to the middle layer of the gate stack. The middle layer is the barrier metal layer referred to in the second paragraph on page 5.

Attachment: Replacement sheet

REMARKS

Examiner Su Kim is thanked for the thorough examination and search of the subject Patent Application. Claims 8, 11-14, 16, and 19-22 have been amended, Claims 1-7 and 28-34 have been canceled, and new Claims 35-52 have been added. No new matter has been added.

The making final of the restriction required is noted. Non-elected claims are hereby canceled. Applicants reserve the right to file a divisional application to the canceled claims.

The Specification has been amended in the paragraph bridging pages 6 and 7 to include the work function adjustment by impurity doping, claimed in original claims 14 and 22 and inadvertently left out of the Specification. The Specification has been amended in the second paragraph on page 5 to reflect the correction to the drawing figure 1. The Specification has also been amended to correct various typographical errors.

Claims 11, 12, 14, 19, and 20 have been amended to correct various typographical errors.

Reconsideration of the objection to Claim 21 is requested in view of amended claim 21. It is believed that the rewording of the claim makes it clear that the work function of the gate electrode is adjusted by adjusting the flow rate of nitrogen during deposition of the hafnium nitride layer, as described at the bottom of page 6 of the Specification.

New claims 35-39 are similar to claims 8-15 except that the capping layer is defined to comprise titanium nitride or tungsten. New claims 40-52 claim deposition of both the first metal layer and the second metal layer and patterning the two metal layers to form the gate electrode.

All Claims are believed to be in condition for Allowance, and that is so requested.

Reconsideration of the rejection under 35 U.S.C. 102 of Claims 8, 16, 24, 26, and 27 as being anticipated by Matsuo is requested in view of Amended Claims 8, 13, 14, 16, 21, and 22 and in accordance with the following remarks.

Claims 8 and 16 have been amended to claim formation of CMOS gate electrodes as disclosed at the top of page 1, the bottom of page 4, the bottom of page 5, and the middle of page 7 of the Specification. Matsuo uses HfN only for NMOS. See paragraph 0018 where the hafnium nitride is removed “from the p-type region alone.” Applicants’ invention uses HfN for both the NMOS and PMOS gate electrodes. Also, Matsuo do not pattern the gate electrode stack as does Applicants’ invention (Claim 8, lines 6-7 and Claim 16, line 5). Matsuo forms a gate trench 112 (paragraph 0012) and forms the gate by deposition and CMP of the gate materials. Furthermore, both NMOS and PMOS gate electrodes have the same mid-gap work function (see the paragraph bridging pages 6 and 7). In Matsuo, the NMOS and PMOS gates may have different work functions (see paragraph 0021).

Applicants’ process of forming CMOS gate electrodes by depositing and patterning a hafnium nitride metal layer is not taught by Matsuo.

Reconsideration of the rejection under 35 U.S.C. 102 of Claims 8, 16, 24, 26, and 27 as being anticipated by Matsuo is requested in view of Amended Claims 8, 13, 14, 16, 21, and 22 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 9 and 17 as being unpatentable over Matsuo and in view of Yu et al is requested in accordance with the following remarks.

The paper "Physical and Electrical Characteristics of HfN Gate Electrode for Advanced MOS Devices", by authors H. Y. Yu, H. F. Lim, J. H. Chen, M. F. Li, Chunxiang Zhu, C. H. Tung, A. Y. Du, W. D. Wang, D. Z. Chi, and D. L. Kwong, is not believed to be a valid prior art reference under 35 USC 102. The only possible subsections of 102 under which it could be considered prior art are subsections 102(a) or 102(b). It is not a valid 102(b) reference, since its publication date of April 2003 was not more than one year prior to the US filing date (03/17/04) of the instant application. In addition, the paper is also not believed to be a valid 102(a) reference since there is overlap between the authors of the paper and the inventors of the instant application, and thus the invention was not known or used "by others".

With the removal of the paper to Yu et al as a reference, the above rejection is considered moot.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 9 and 17 as being unpatentable over Matsuo and in view of Yu et al is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 13 and 21 as being unpatentable over Matsuo and in view of Yu et al is requested in accordance with the following remarks.

With the removal of the paper to Yu et al as a reference as detailed above, the rejection is considered moot.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 13 and 21 as being unpatentable over Matsuo and in view of Yu et al is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 14 and 22 as being unpatentable over Matsuo and in view of Yu et al is requested in accordance with the following remarks.

With the removal of the paper to Yu et al as a reference as detailed above, the rejection is considered moot.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 14 and 22 as being unpatentable over Matsuo and in view of Yu et al is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 25 as being unpatentable over Matsuo is requested in accordance with the following remarks.

In alternative processes of Applicants' invention, HfN is either the first metal or the second metal layer. As discussed above, Matsuo does not use patterning to form the gate electrode and Matsuo uses HfN only for NMOS gate electrodes and not for PMOS gate electrodes. Applicants' invention deposits and patterns HfN to form both the NMOS and PMOS gates in a CMOS semiconductor device. This is not taught or suggested by Matsuo.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 25 as being unpatentable over Matsuo is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 10-12, 15, 18-20, and 23 as being unpatentable over Matsuo is requested in view of Amended Claims 8, 13, 14, 16, 21, and 22 and in accordance with the following remarks.

The instant claims provide further details about the invention claimed in amended independent claims 8 and 16. As discussed above, Applicants' invention of depositing and

patterning HfN to form both the NMOS and PMOS gates in a CMOS semiconductor device is not taught or suggested by Matsuo.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 10-12, 15, 18-20, and 23 as being unpatentable over Matsuo is requested in view of Amended Claims 8, 13, 14, 16, 21, and 22 and in accordance with the remarks above.

Applicants have reviewed the prior art made of record and not relied upon and agree with the Examiner that while the reference is of general interest, it does not apply to the detailed claims of Applicants' invention.

Allowance of all Claims is requested.

It is requested that should Examiner Kim not find that the Claims are now Allowable that the Examiner call the undersigned at 765 4530866 to overcome any problems preventing allowance.

Respectfully submitted,

A handwritten signature in cursive script, reading "Rosemary L. S. Pike".

Rosemary L. S. Pike. Reg # 39,332

Attachment: Replacement drawing sheet